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Highlights of Recent Changes to 1B Reports

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Stakeholder Steering Committee Meeting

December 17, 2008

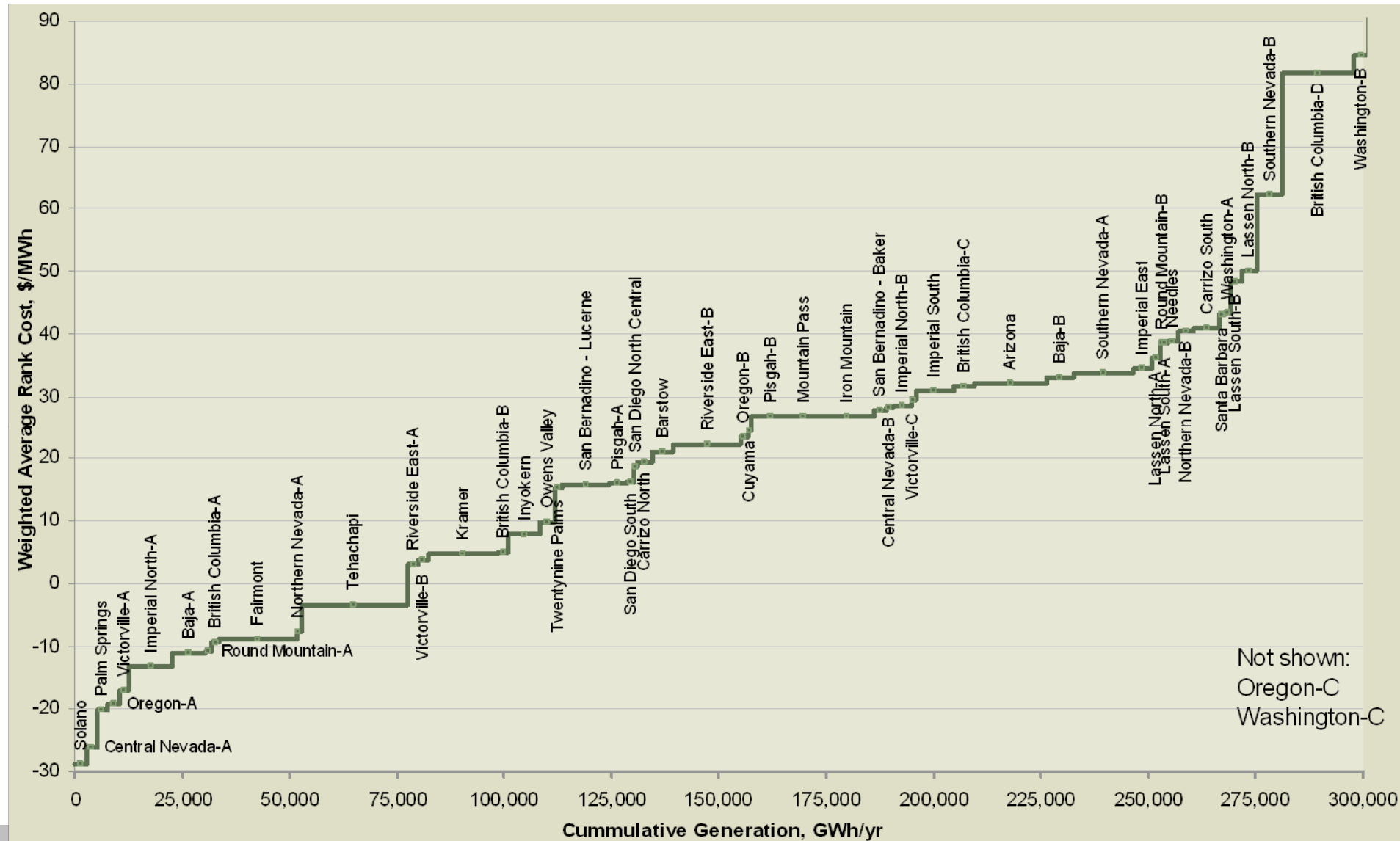
Major Changes Between November 4 Draft and December 5 and 12th Drafts

- December 5
 - Revised Lassen North/South Wind
 - Revised Uncertainty Analysis – Probabilistic Assessment, 1 standard deviation
 - Subdivided OOS Resources and added to Supply Curves
 - Highlighted Baja Technical Potential for Wind
 - Full Allocation of Transmission Cost Sensitivity
 - Proxy / Pre-ID Clarifications
 - Reduced Solar Costs
 - Better Maps

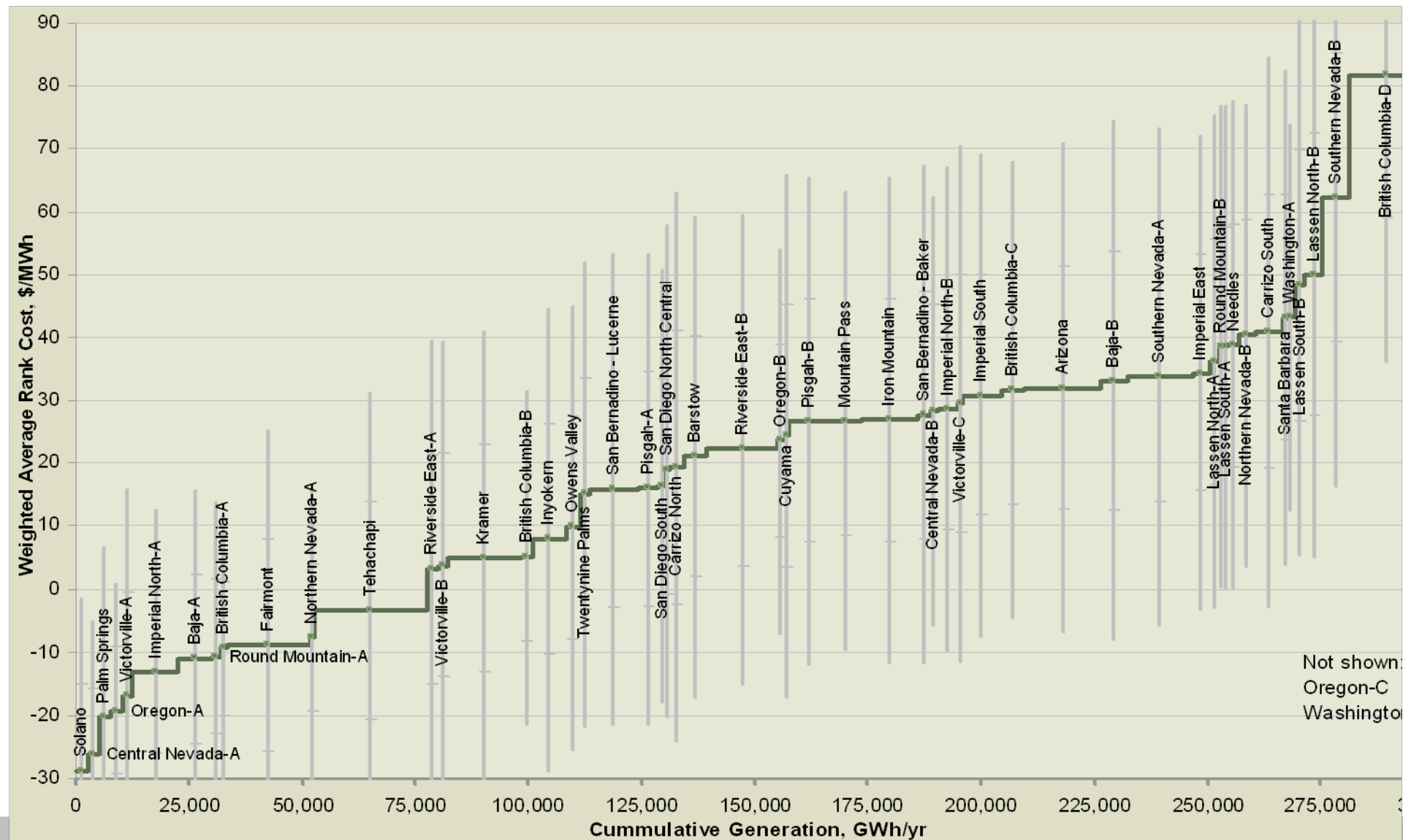
Major Changes Between November 4 Draft and December 5 and 12th Drafts

- December 12 Draft
 - Revised Uncertainty Analysis – 2 Standard Deviations
 - No Transmission Cost Supply Curve
 - Added OOS Resource to Bubble Chart

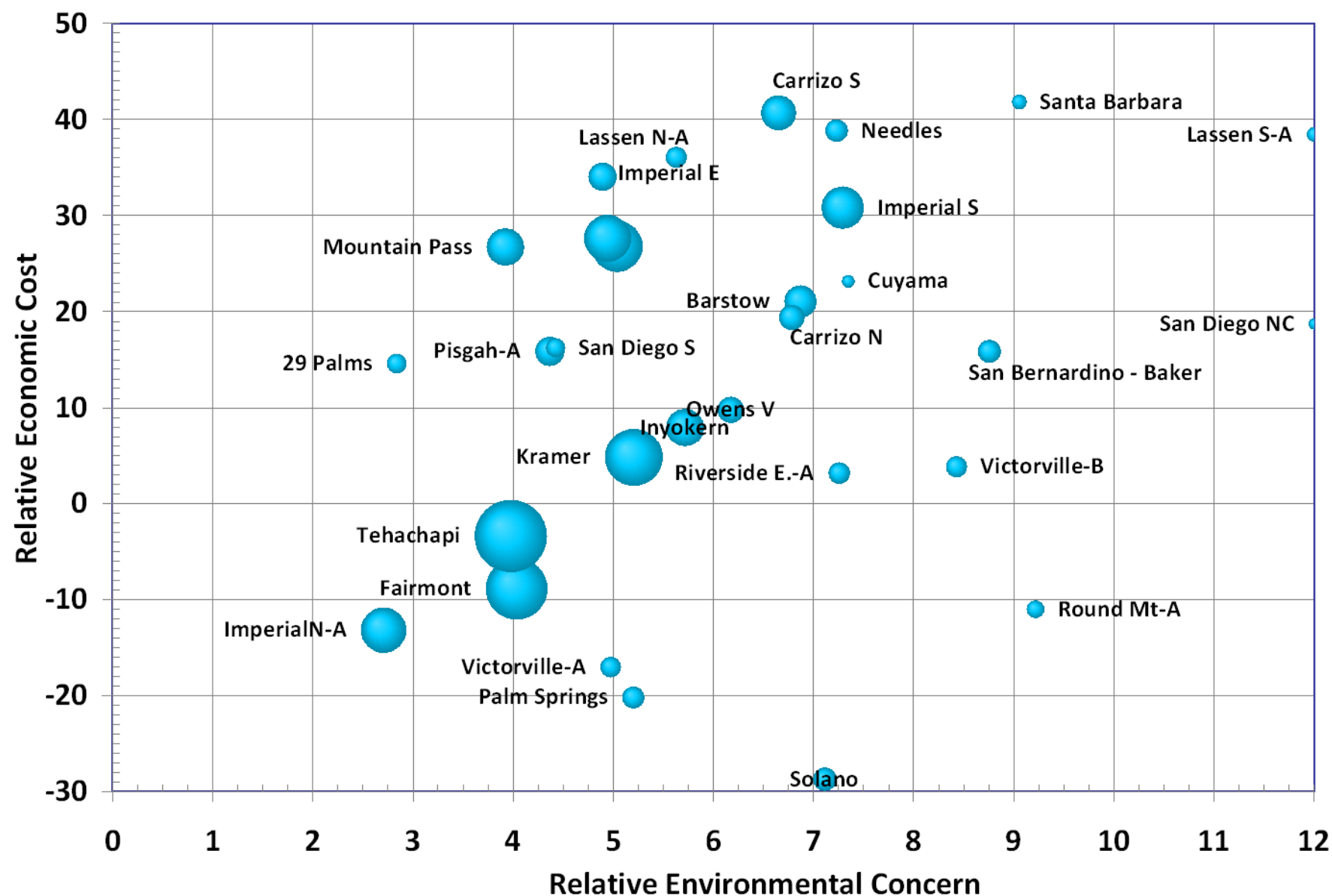
New RETI Supply Curve



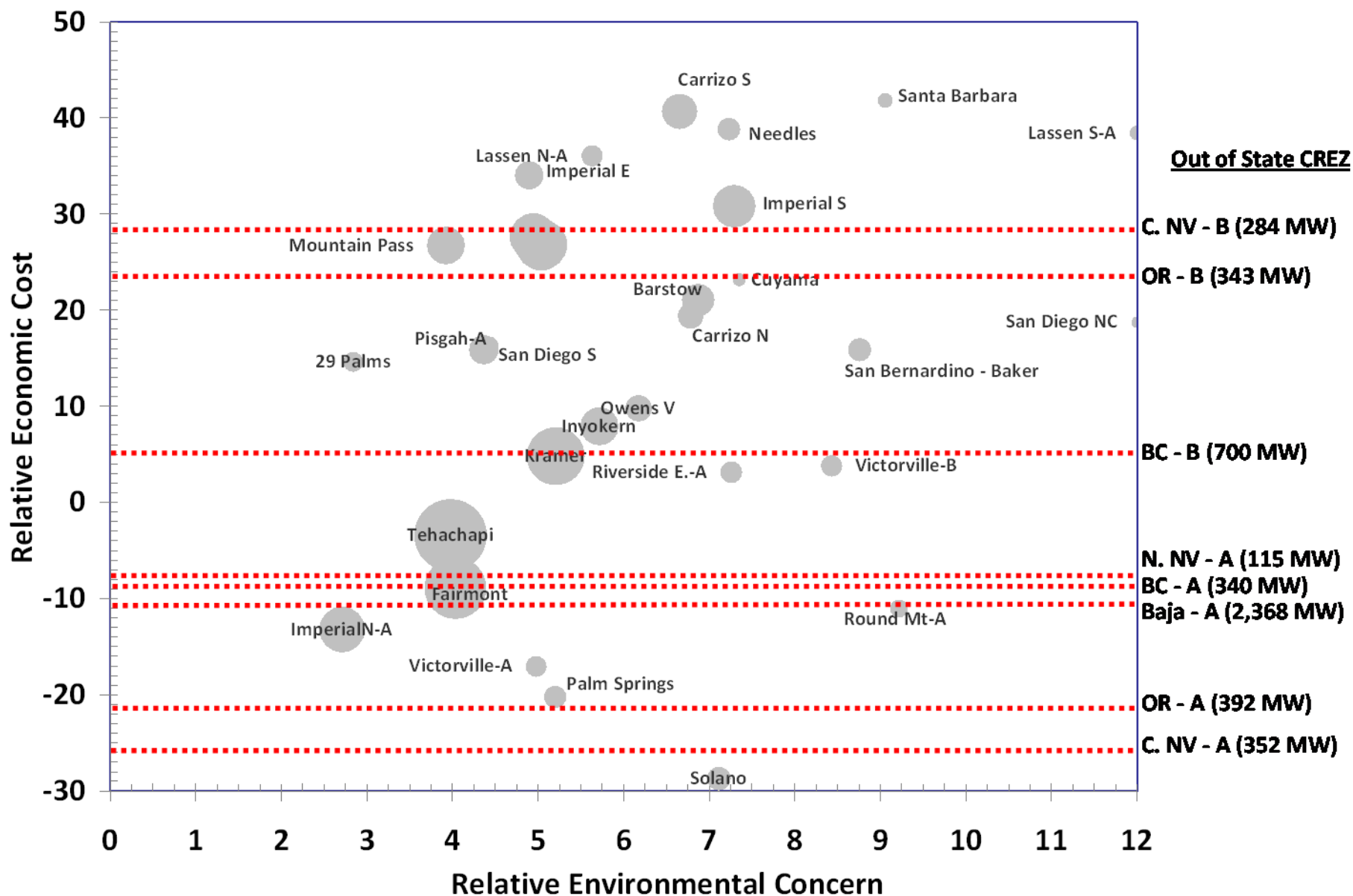
December 12 Uncertainty Analysis



December 12 Bubble Chart



December 12 Bubble Chart + Out-of-State





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Renewable Energy Transmission Initiative

Transmission Modeling & Cost

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Stakeholder Steering Committee Meeting

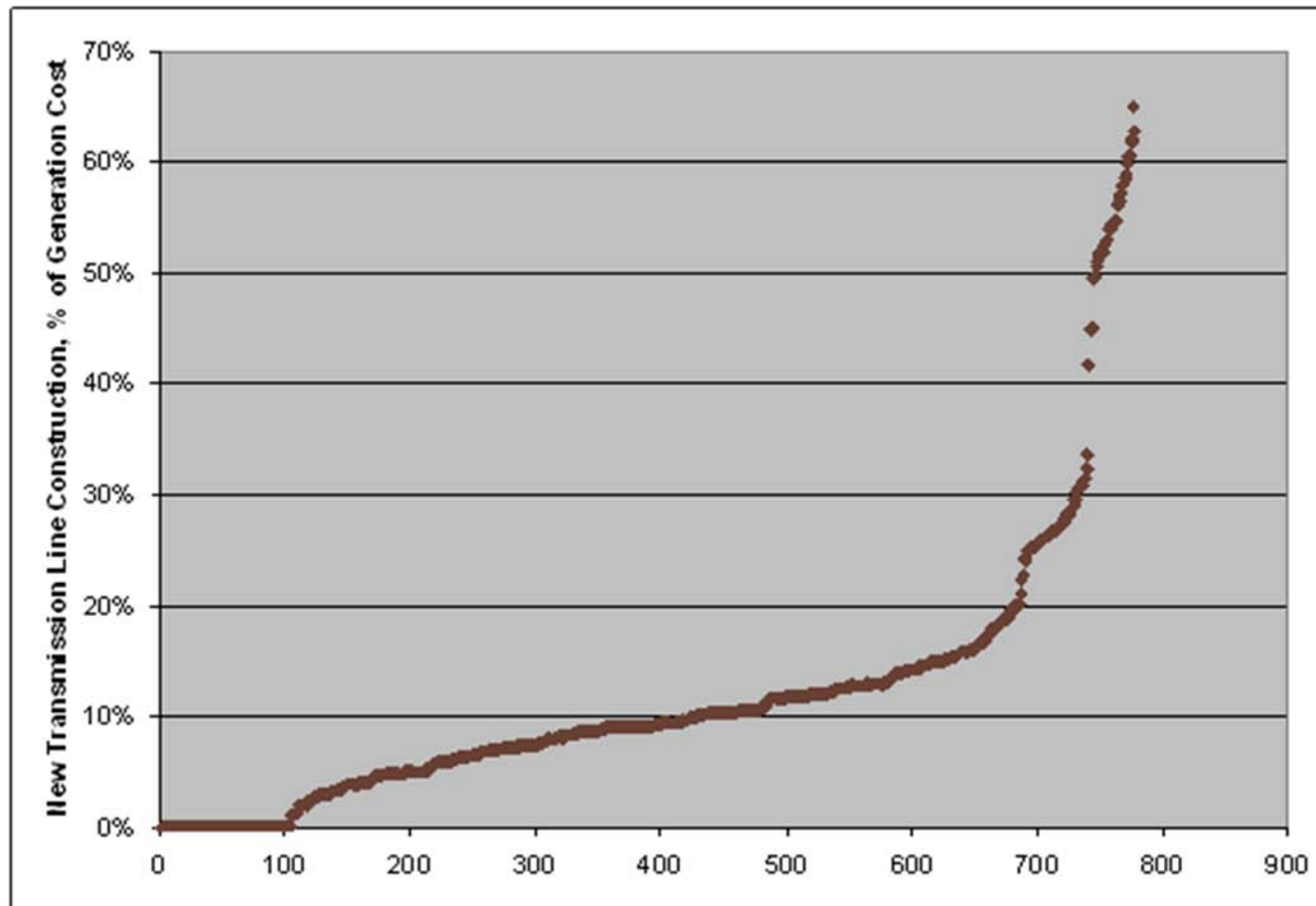
December 17, 2008

RETI Transmission Cost and Analysis

- RETI transmission results and cases
- Overview of approach to transmission costs
- Methodology
- Assumptions
- Example – Central Coast transmission build-out and costs
- Transmission model is available

RETI Phase 1 Transmission Results

- Cost of transmission for most resources is small portion of total cost



RETI Phase 1 Transmission Cases

- RETI benchmarked transmission cost with SCE TRCR, which were provided on similar \$/MWh basis – results very similar for most CREZ

Transmission Cost Comparison - RETI and SCE TRCR (\$/MWh)		
<u>Resource Area (CREZ)</u>	<u>SCE</u>	<u>RETI</u>
Kern County (Tehachapi)	16-19	17
Pisgah	21-22	22-23
Mohave/El Dorado (S. NV)	28-31	33
Mountain Pass	7	31
Victorville	11	16-19
Kramer	10-12	20
Inyokern	18	23
Control	36	39
Devers (Palm Springs)	15	16

RETI Phase 1 Transmission Cases

- 11/4/08 1B Draft Report
 - Base case: no incremental capital cost for approved transmission
- 12/5/08 Draft Final 1B Report
 - Full Allocation Sensitivity – included incremental capital cost for approved transmission
- 12/12/08 Final 1B Report
 - No transmission capital costs presented

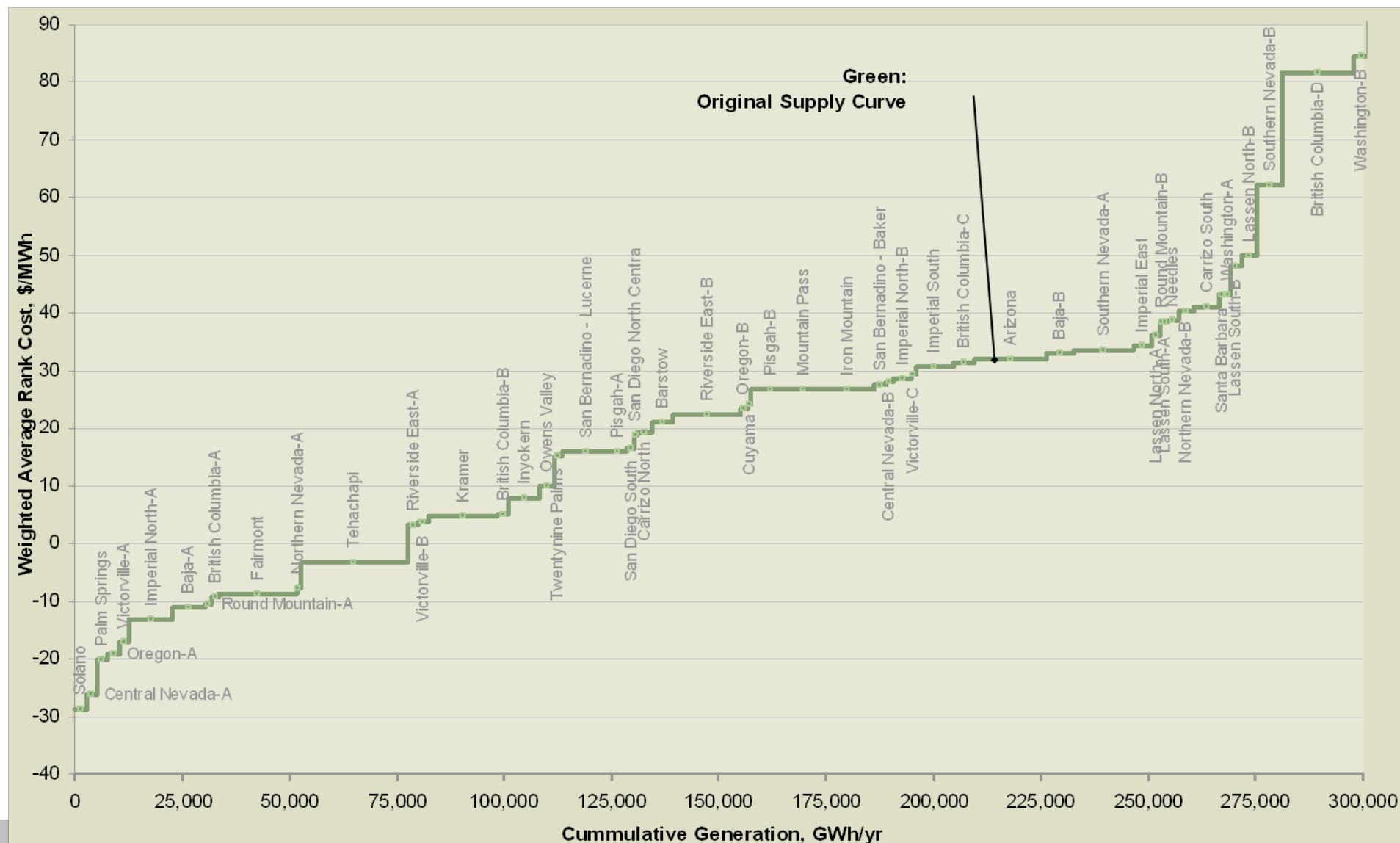
Full Transmission Cost Allocation - Minimal Impact

Table 5-15. Economic Analysis Results – Full Transmission Cost Allocation.

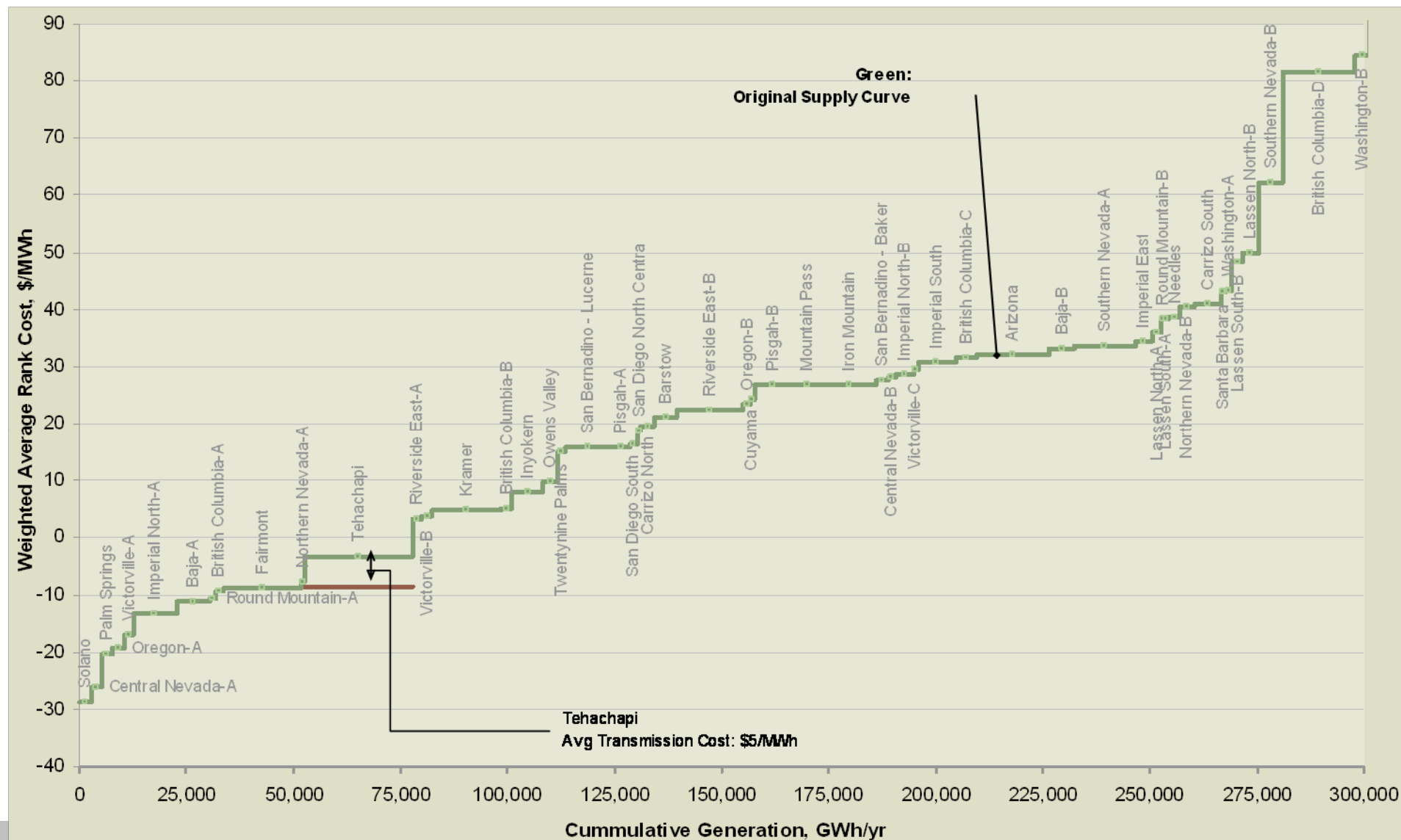
CREZ Name	Annual Energy (GWh/yr)	Cumulative Energy (GWh/yr)	Weighted Average Rank Cost (\$/MWh)
Solano	2,721	2,721	-29
Palm Springs	2,465	5,186	-20
Victorville-A	2,112	7,298	-17
Round Mountain-A	1,598	8,896	-11
Imperial North-A	10,095	18,990	-9 (was -13)
Fairmont	18,318	37,308	-8 (was -9)
Tehachapi	25,091	62,400	-3
Victorville-B	2,267	64,667	4
Kramer	16,251	80,918	5
In-state Non-CREZ Resources	2,206	83,124	-29
Out-of-state Resources	15,010	98,134	-13 (was -14)

Riverside East A – Dropped from top 10 CREZ

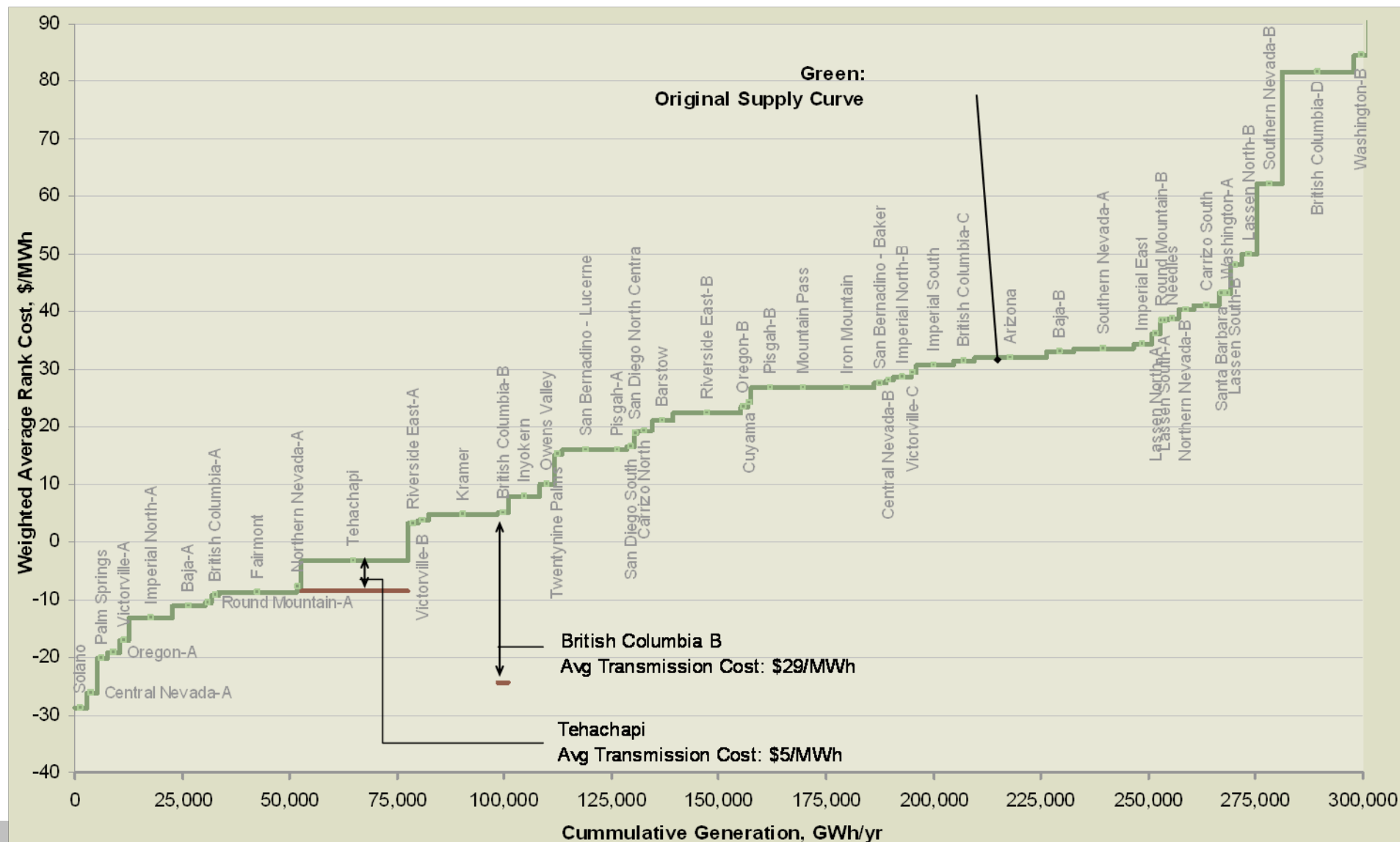
New RETI Supply Curve



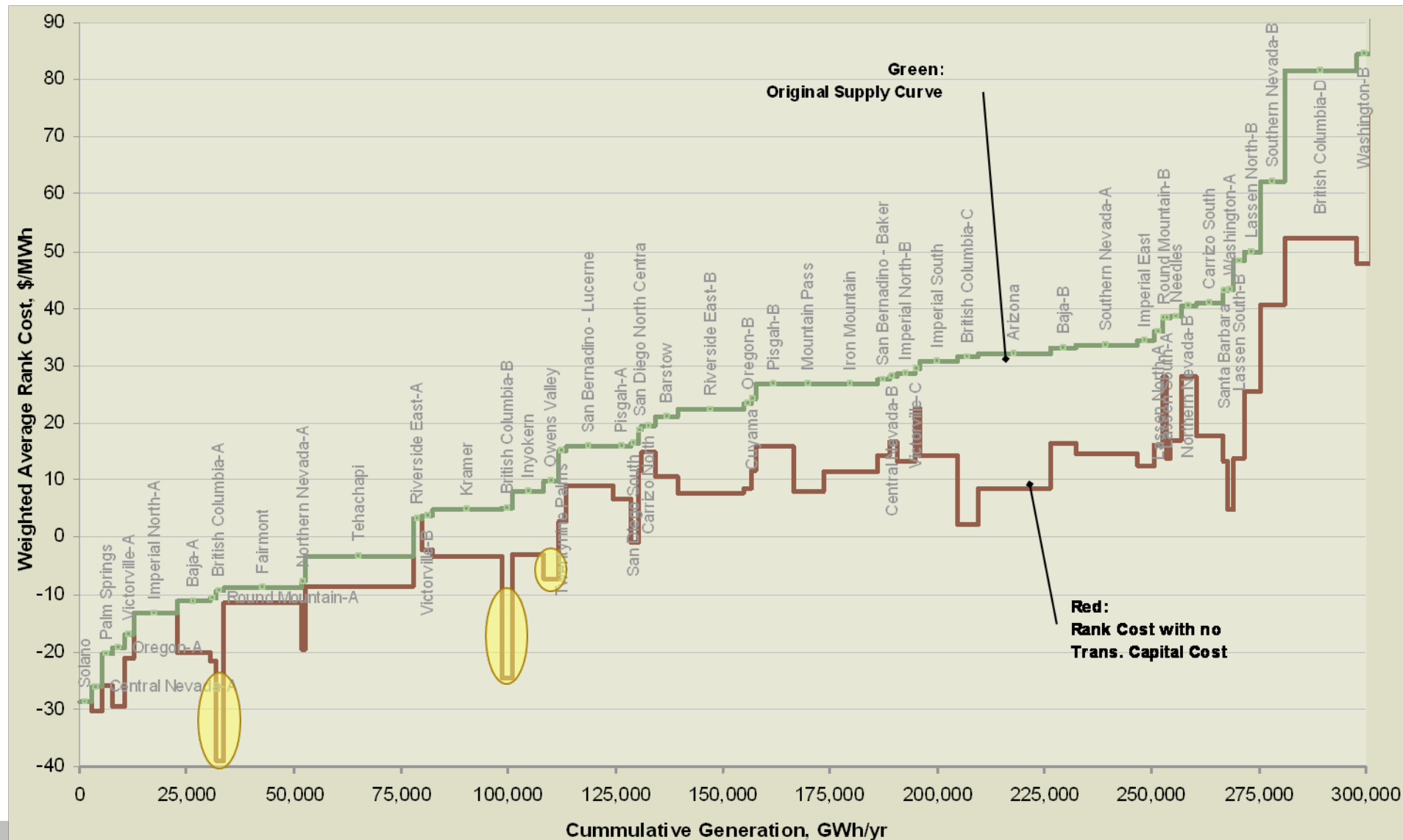
No Transmission Capital Costs for Tehachapi



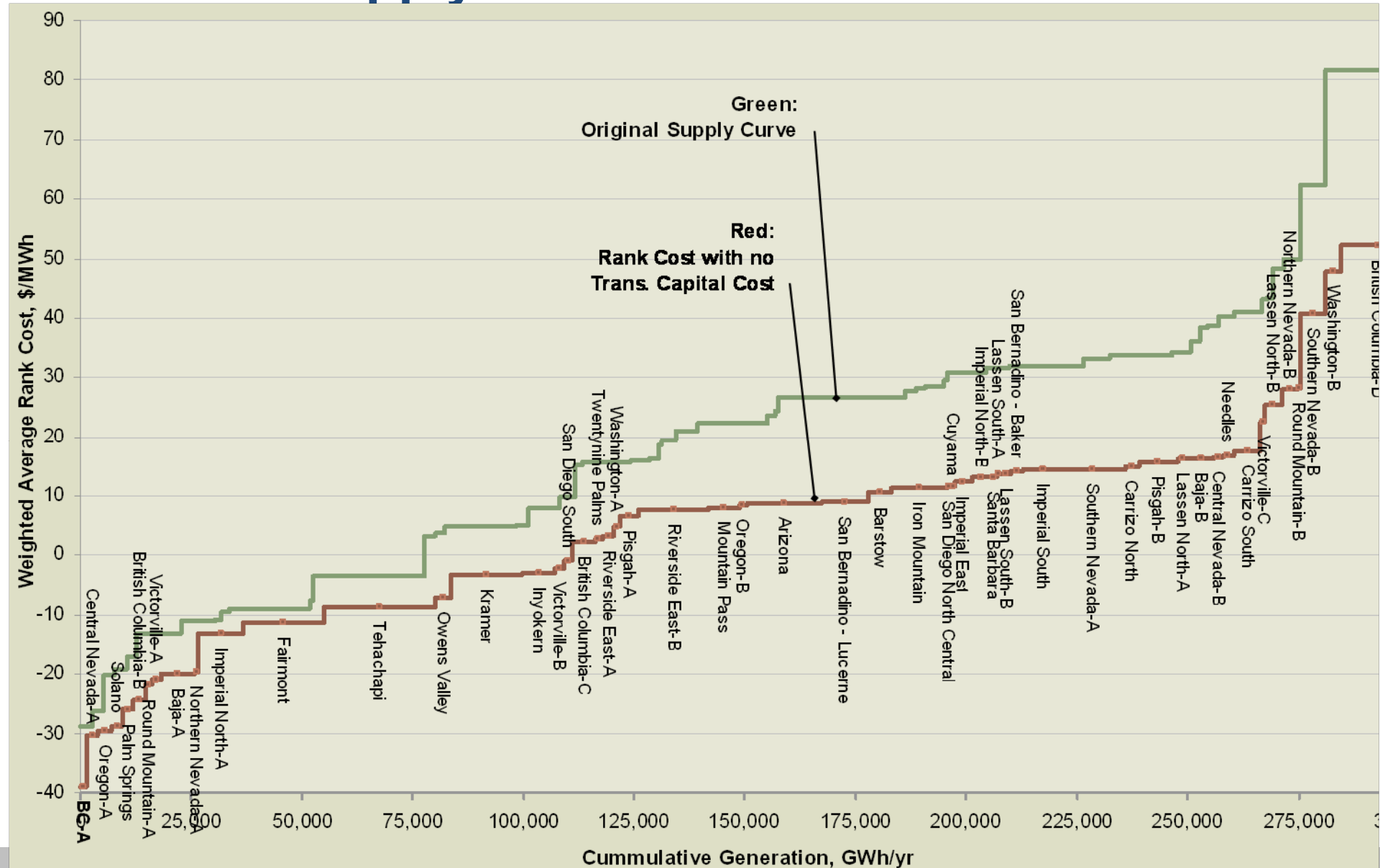
No Transmission Capital Costs for British Columbia



No Transmission Capital Costs



Resorted Supply Curve



RETI Approach to Transmission Costs

- Goal for Phase 1: Develop ***screening-level*** transmission costs to allow for relative comparison of resources from various locations
- Transmission capacity added to deliver energy to load areas based on resource capacity, not energy
- Approach discussed with modeling work groups
 - Phase 1A Work Group - 2/28/08
 - Phase 1B Work Group - 7/03/08

Transmission Cost Methodology (from 2/28/08)

- Levelized Cost of Transmission (LCOT) - \$/MWh
 - Calculated with economic model consistent with that used by California I

Fixed Costs

- Resource interconnection costs
- Network upgrade costs
- Trunk line costs

Variable Costs

- Transmission access / wheeling charges
 - Assume CAISO charges for all projects
 - Pancake wheeling rates for out-of-state resources
- FTR/CRRs – no cost / value assumption

Transmission Cost Methodology (from 2/28/08)

- Transmission costs will be additive
- Except wheeling, transmission costs will be allocated on a per-MW basis.

(This is a planning assumption, not a rate-making proposal)

Potential Transmission Costs

Transmission Type	Interconnection Costs (\$/MW-mile based on location)	Network Upgrade Costs (\$/MW)	Substation development cost (\$/kW)	New transmission / trunk line costs	Non-CAISO wheeling costs (\$/MWh)	CAISO transmission access (\$/MWh)
California project connecting to existing transmission facilities	Yes	Yes	No	No	No	Yes
California project connecting to new transmission	Yes	No	Yes	Yes		Yes
Non-California projects delivering power to California	Yes	Depends	Depends	Yes	Yes	Yes

Transmission Cost Methodology (from 2/28/08)

- Transmission costs for new facilities will be allocated to

Example:

A region has the potential for 3000 MW of cost-effective generation

1500 MW to be installed in 2012

1500 MW expected to be installed in 2015

RETI would add transmission in 2012 to accommodate all 3000 MW

The cost allocated to each MW would be the same, whether it went on-line in 2012 or 2015

Transmission Assumptions (from 2/28/08)

- Transmission system will largely use existing substations
 - Existing substations and lines used to place new transmission
- Use TRCR data where possible and applicable
- New transmission cost data – B&V estimates

Transmission Cost Assumptions



Gen-tie (part of facility cost)	Connection to nearest substation (Collector point) - new or existing
	Equipment costs based on facility size (i.e. 50 MW, 50-200 MW, >200 MW)
Collector Point	New or existing substation upgraded. Station capacity based on total MW of projects
Trunk line	Connects connector points to existing HV transmission
	Line size based on total resource capacity (shouldn't this be 230 kV? 345 kV or 500 kV)
	Alignment based on existing lines where possible
	Cost = \$/MW-mile based on terrain
HV Substation	New or existing substation upgraded. Station capacity based on total MW of projects
Network Costs	Grid interconnection costs. Use TRCR cost if HV substation is named.

Transmission Cost Assumptions

Gen-tie costs

- Cost to transport power from facility to existing or new
- Line selected based on resource size
- **Straight**-line distance measured using GIS to substation
- Cost borne by the generator to interconnect

Transmission Cost Assumptions

Substation / Collector Station costs

- Cost to add new transformers/equipment to receive power
- Collector size and cost based on total MW connected to collect

Voltage Class (kV)	No Positions Allowed in a Ring Bus	Base Cost (\$M)	Unit Bay Per Position		
			Ring Bus (\$M)	Brkr + 1/2 (\$M)	Difference (\$M)
0	0	\$0.0	\$0.0	\$0.0	\$0.0
12.5	6	\$0.6	\$0.4	\$0.6	\$0.2
34.5	6	\$0.8	\$0.5	\$0.8	\$0.3
69	6	\$1.0	\$0.7	\$1.1	\$0.4
115	6	\$1.2	\$0.9	\$1.4	\$0.5
230	6	\$1.6	\$1.4	\$2.1	\$0.7
500	3	\$2.4	\$2.8	\$4.2	\$1.4

Notes:

1. Total substation cost = (base cost) + (unit bay cost)*(number of line positions at that voltage) + transformation costs
2. Each substation has only one "base cost", as determined by the maximum line voltage (e.g. the voltage of the line leaving the station).
3. Unit bay costs assume ring bus configuration up to 6 positions (at that voltage) and breaker + 1/2 configuration for 7+ positions (at that voltage).
4. Breaker + 1/2 configuration bay assumed to cost 150% of ring bus bay.
5. Transformation costs are shown on a separate tab.

Transmission Line Size and Cost

Trunk-lines/ new transmission costs

- Line size (kV), # circuits and conductors added to meet total REZ resource capacity
 - 200 MW - 110 kV (single-circuit)
 - 500 MW – 230 kV (double circuit)
 - 1000 MW – 500 kV (single-circuit)
 - 2000 MW – 500 kV (double-circuit)
- Line cost based on line characteristics w/ adjustment factors:
 - Length - lines < 20 miles include adder
 - Terrain adjustment factors
 - Agricultural – 15%
 - Forest – 30%
 - Water – 20%
 - Urban – 15%

New Transmission Line Costs and Multipliers

Min Load (MW)	Max Load (MW)	T-Line Cost (\$/mile)	Voltage (for ref) kV	No. Circuits	Assumed Conductor Size	ROW Width (ft)	ROW (acres per mile)	RETI Max MW-mile
0	0	\$0.00	0	0		0	0.0	0.0
0.1	5	\$0.25	12.5	1	4/0	40	4.8	30
6	10	\$0.27	34.5	1	3/0	50	6.1	230
11	15	\$0.34	34.5	1	266.8	50	6.1	300
16	25	\$0.38	69	1	4/0	80	9.7	2,200
26	40	\$0.43	69	1	336.4	80	9.7	2,900
41	50	\$0.48	69	1	477	80	9.7	3,500
51	70	\$0.49	115	1	336.4	100	12.1	11,000
71	90	\$0.54	115	1	477	100	12.1	13,000
91	110	\$0.59	115	1	636	100	12.1	15,000
111	125	\$0.63	115	1	795	100	12.1	16,000
126	140	\$0.65	115	1	954	100	12.1	17,000
141	175	\$0.70	115	1	1272	100	12.1	18,000
176	200	\$0.75	115	1	1590	100	12.1	20,000
201	250	\$0.78	230	1	795	130	15.8	80,000
251	325	\$0.86	230	1	1272	130	15.8	90,000
326	400	\$0.92	230	1	1590	130	15.8	100,000
401	500	\$1.00	230	2	795	130	15.8	160,000
501	600	\$1.07	230	2	1033	130	15.8	180,000
601	800	\$1.23	230	2	1590	130	15.8	200,000
801	900	\$1.35	500	1	(2) 1272	200	24.2	450,000
901	1100	\$1.44	500	1	(2) 1590	200	24.2	500,000
1101	1300	\$1.74	500	1	(3) 1272	200	24.2	550,000
1301	1500	\$1.90	500	1	(3) 1590	200	24.2	600,000
1501	1750	\$2.20	500	2	(2) 1272	200	24.2	900,000
1751	2000	\$2.40	500	2	(2) 1590	200	24.2	1,000,000

Unit Cost Adjustment Factors

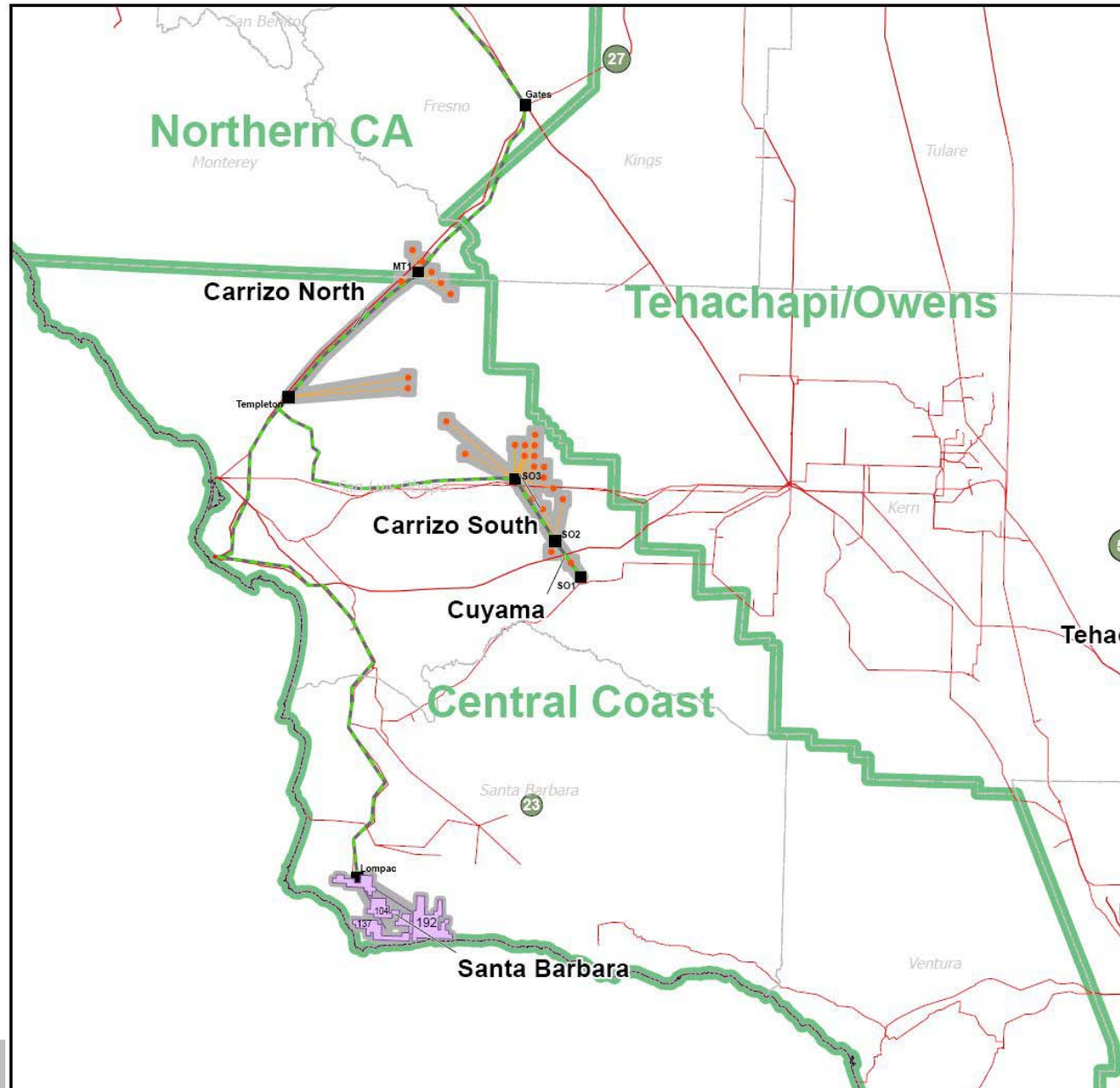
Line Length Adjustment Factor (for lines less than 20 miles in length)

LLAF = $2 - (L/20)$; where L = Line Length in miles;

Terrain Adjustment Factor

Major Land Use	TAF
AGRICULTURE_	1.10
AGRICULTURE_BIA	1.10
AGRICULTURE_BLM	1.10
AGRICULTURE_DOD	1.10
AGRICULTURE_FS	1.10
AGRICULTURE_FWS	1.10
AGRICULTURE_NPS	1.10
FOREST_	1.30
FOREST_BIA	1.30
FOREST_BLM	1.30
FOREST_BOR	1.30
FOREST_DOD	1.30
FOREST_FS	1.30
FOREST_NPS	1.30
SHRUB-BARREN-HERBACEOUS_	1.00
SHRUB-BARREN-HERBACEOUS_BIA	1.00
SHRUB-BARREN-HERBACEOUS_BLM	1.00

Example – Central Coast Resource Area



Example – Central Coast Resource Area

Central Coast CREZs– 5,533 MW resources defined req

	Biomass	Geo-thermal	Dist. Solar PV ^a	Large Solar ^b	Wind	Total
Capacity (MW)						
Carrizo North				1,600		1,600
Carrizo South				3,000		3,000
Cuyama				400		400
Santa Barbara					433	433
CREZ Total				5,000	433	5,433
Non-CREZ Resources	23		920		77	1,019
Grand Total	23		920	5,000	509	6,452
Generation (GWh/yr)^c						
Carrizo North				3,395		3,395
Carrizo South				6,440		6,440
Cuyama				892		892
Santa Barbara					1,180	1,180
CREZ Total				10,727	1,180	11,907
Non-CREZ Resources	159		2,046		230	2,435
Grand Total	159		2,046	10,727	1,410	14,342



Thank You!

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